Think Piece for ***Civil Engineering and Environmental Systems***
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After the Quake

Abstract
The 1995 book, "Wellington after the quake: the challenge of rebuilding cities", is reviewed in light of the 2010/2011 Canterbury, New Zealand, earthquakes. Lessons are drawn related to the difficulties of recovery of complex infrastructure systems after disasters.

Keywords: natural disasters, lifelines, New Zealand, disaster recovery, re-insurance.

It was 12:51 pm on a Tuesday afternoon in February 2011, in Christchurch, New Zealand when a sudden jolt nearly threw me out of my office chair at the University of Canterbury. From under the desk where I had quickly taken shelter, I watched all my books and files tumble off the shelves. 'Here we go again,' I thought. 'Like last September's quake, but maybe not as bad.'

Once I got home and could hear descriptions over the radio (and later, after the power came back on, from the television) of deaths and rescue attempts, I realised this was bigger than I had thought. Although my own life was relatively untouched by the earthquake, many others were not so fortunate, and it was clear I would live in a different city from then on.

The immediate response efforts after the February Christchurch earthquake were exceptionally good and thorough. The long years of building up 'lifeline' services, and the training of Civil Defence teams, had proven worthwhile. What was less clear was how the city would recover after the immediate response phase had ended. Once the world media left, and the wonderful home baking shipments from around New Zealand stopped, what problems would my region need to face?

With the University closed for weeks, I ended up working part-time on special University security teams, and looking for something to read. I pulled an unread book out of a pile of 'things to read one day', opened it at page one and started learning.

Back in 1995, the Earthquake Commission (the New Zealand entity charged with administering insurance against earthquake damage) and the New Zealand Centre for Advanced Engineering hosted a conference called *Wellington after the Quake: The Challenge of Rebuilding Cities*. The scenario for everyone to consider was a magnitude 7.5 earthquake in Wellington leading to 1600 dead, hundreds of commercial buildings damaged or collapsed, 3000 uninhabitable homes, and major damage to roads, bridges, and other lifelines. It all sounded eerily familiar.

I wasn't there at the conference and hadn't been involved in the fields of disaster preparation or response until I began a project on disaster waste management in 2009, so I cannot say I'm an expert on these topics. However, it's easy to see that the problems of restoring infrastructure systems are many and that a need for a systems approach is great. I thought that in that book there were many valuable lessons worth repeating, and worth sharing with an international audience.

How well did we in New Zealand pay attention to what people had said at the 1995 conference? My answer would be that we did pretty well at learning lessons, except for a key one, which is that we need to plan for how to recover, and not just respond, after an earthquake.

Planning *after* a disaster is too late, because reaching social agreement is so much more difficult at that stage. Steven French of Georgia Tech University made this point at the conference and noted that, especially after earthquakes, long delays in recovery can result from attempts to come up with rebuilding plans, and all because people try to solve not only the recovery problem but also problems perceived to have existed *before* the disaster. Large changes in urban layout, design, and philosophy are made more difficult, not easier, by the

disaster. Earthquakes in particular (in contrast to, say, cyclones) leave a patchwork of remaining buildings that will make wholesale change costly. In addition, the high emotions and social tensions resulting from a disaster make bringing about social change more difficult, not easier. Altering the form of a city means changing its roads, sewers, and power systems; but even with the situation of major infrastructure damage, the additional cost of shifting to new places or methods is far too high, and would come at a time when funds are critically needed elsewhere. What I took from this analysis is that to an extent I had not appreciated, we should look to rebuild, and to afterwards enter into discussion about change.

One of the critical drivers that limit change during recovery is the need to reinstate commercial and industrial activity as quickly as possible. Steven French emphasised creative approaches to get commerce active again that had been taken after the Northridge earthquake in California, including the establishment of shopping bazaars in local parks. Commercial activity can benefit from small changes instituted with a rebuild and he gives the example of Santa Cruz, where the rebuilt area was more attractive to shoppers than the original had been. One change being considered in the commercial area of Christchurch is the creation of parks along formerly built-up riverbanks that were affected by liquefaction.

Another speaker, Christopher Henri from the Insurance Council of Australia, brought up a related point about planning after a disaster, based on his experiences in Darwin after the 1974 cyclone. The Reconstruction Commission there decided not to develop a new city plan, which would have taken too long, or to enforce the old city pan, with its exposed inadequacies and irrelevance to a new setting. Instead, the Commission brought in a number of ways to encourage or discourage certain practices, rather than setting new rules or making long-lasting decisions on particular land use applications. This gave the Commission flexibility and also gave individual land owners and businesses an ability to be creative in their response. Over time, as decisions were made and it became clearer through a series of case-by-case decisions which land uses were appropriate where, and under what conditions, I would imagine that the City would codify common practice into a new city

plan. This flexibility and emphasis on outcomes rather than methods seems a good way forward during a recovery.

A number of the speakers at the conference brought up problems of delay during a recovery. The inter-governmental squabble over historic buildings after the Loma Prieta earthquake in California led to long delays, and also wasted administrative effort. Which buildings to save? To what standard should the repair be conducted? Who will pay? An agreed policy in advance of the event could have saved years of meetings, consultant reports, court cases, and delays. Similarly, after the cyclone hit Darwin, the slow deliberations over what the new building code should be led to overall recovery delays. Although we should not revise a building code only after death and destruction, we can be ready to incorporate new knowledge quickly.

The one case study of delays in the book that haunted me the most was of the 1987 Whittier earthquake in the Los Angeles Basin, where a magnitude 5.9 shallow earthquake hit in a highly urbanised area. Recovery there went extremely slowly, to allow for a comprehensive plan of the land use and character of redevelopment. In addition to the problem of no pre-earthquake plan for redevelopment, and the problem of delays arising from the time required to develop a detailed, prescriptive plan afterwards, Whittier had problems with slow approvals of building permits, shortage of administrative staff, debates over historic buildings, and a general shortage of labour needed for recovery. The delays led to lawsuits, which created further delays.

Labour issues are mentioned a number of times in the book as significant bottlenecks in recovery programmes. Early on, the accommodation of recovery workers can be a major problem; earthquakes are likely to hit lower-income housing disproportionally, decreasing the availability of short-term accommodation for workers. Tony Lanigan, a management consultant, looked at all the potential labour, material, and equipment bottlenecks in the 1995 Wellington recovery scenario, and considered accommodation of labour to be the most critical. Frank Holmes, then Director of the Bank of New Zealand, highlighted a need for government to change its '… training programmes and immigration policies to ease

potential shortages of labour…' and so preserve '… reasonable stability of prices'. These issues of labour quantity and quality and inflation impacts are likely to become greater as rebuilding gains momentum in Christchurch.

A number of the conference participants discussed the difficulties that have arisen when there has been no central authority responsible for recovery. Having one central authority can prevent some of the inter-institutional paralysis, delays and excess costs in recovery. However, these central authorities still need to be receptive to the public and to communicate effectively. Without care, the tension between acting quickly and communicating effectively is bound to cause a rupture. In Darwin, a Citizen Advisory Council was established that bypassed elected officials and received direct input from residents, and this was found to be effective. Another response that caught my attention was in relation to the 1989 Newcastle earthquake in Australia. Henri describes the development and distribution of a report entitled *Factors Influencing Structural Behaviour of Residential Buildings in Newcastle*. Providing this document to all builders, structural engineers, and insurance inspectors, as well as to interested building owners, proved very useful. Before its release, a large number of misunderstandings and inconsistencies in explanations had increased social tension. For example, a houseowner would wonder why their house had been assessed as having only $10,000 of damage, while the neighbour's had been assessed as a total loss. The need for information related to complex technical decision-making on the status of buildings will remain strong in Christchurch for many years.

Peter Yanev, of what is now the risk assessment firm ABS Consulting, estimated that 50% of the insurance payout after the Northridge earthquake was, in effect, insurance fraud. Policy owners claimed for damage that was not due to the earthquake, and the cost of 'repairs' was more than the minimum required. If this is a precedent, New Zealand is about to see some friction between insurance companies and the Earthquake Commission on the one side and building owners on the other. The need for proper cost control systems and clear communication will be very high. I do not want a job handling insurance claims anytime soon.

The other eye-opener from the insurance industry related to how poorly premiums match the underlying risk from natural disasters. Peter Yanev noted how many insurance companies offering earthquake cover quoted similar rates independent of how the sub-surface risk varied. He provided a number of details from the Northridge earthquake on how his company had done better compared with others in terms of payouts. His company had years previously begun selling earthquake insurance to those they thought were safer than most, undercutting the cost of the broad-brush insurers. They looked at detailed geotechnical assessments, considering the distance to known faults, the soil condition, and the geology. Their method is so obvious, and maybe things have changed since 1995, but it still leads to the question, why isn't this common practice? Surely it would make sense for society to assess, pre-disaster, the site's risk and also the ability of the building to withstand a disaster load, and charge insurance accordingly.

I think much of the answer lies in the role today of 'reinsurers'. Re-insurers insure the insurance companies against very large payouts on rare events such as earthquakes. From the viewpoint of the insurance company there is little incentive to pay the extra cost in assessing risk when they know that in any large disaster they will pay the same amount, and the re-insurance company will pay the extra associated with their having made poor estimates of risk. On the other hand, there's no doubt that re-insurers pay great attention to the risk and that they conduct detailed investigations using the latest science and technology. At the 1995 conference Werner Schaad from Swiss Re provided a detailed examination of the cost of a major earthquake in Wellington. What he did not make clear was whether re-insurers would charge insurance companies less if they issued more risk-dependent insurance policies. In the end, if the economic signal of risk does not make its way to the property owner, we are just setting ourselves up for paying more as a society for every disaster.

At some point, we need to turn hindsight into foresight. For many years, Christchurch will provide a valuable case study for researchers worldwide interested in what works in a disaster recovery and what does not. I hope that we will see a number of papers in ***Civil***

Engineering and Environmental Systems on response and recovery for infrastructure systems.

The conference back in 1995 put a great deal of effort into helping Wellington prepare for its future 'big one'. In some ways, it's an excusable failure of imagination to not institute policies in a country when it has not had a disaster before of the scale that was envisioned for Wellington back in 1995. It is even more excusable that Christchurch did not have a detailed earthquake recovery plan in place pre-disaster, when the risk had been assessed as low. From now on, what will be much more difficult to excuse would be other parts of New Zealand not planning now for a disaster, and instead being left with rubble, damaged citizens and a slow, difficult recovery.

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Reference

Wellington After the Quake: The Challenge of Rebuilding Cities, Earthquake Commission and Centre for Advanced Engineering, Wellington, New Zealand, 284 p, ISBN 0-908993-10-2, 1995.